



Daily patterns in nonsuicidal self-injury and coping among recently hospitalized youth at risk for suicide

E.K. Czyz^{a,*}, C.R. Glenn^b, D. Busby^a, C.A. King^{a,c}

^a Department of Psychiatry, University of Michigan, Ann Arbor, MI, United States

^b Department of Clinical and Social Sciences in Psychology, University of Rochester, Rochester, NY, United States

^c Department of Psychology, University of Michigan, Ann Arbor, MI, United States



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ABSTRACT

Among adolescents at high suicide risk, using a daily diary design, this study examined: (1) the co-occurrence between nonsuicidal self-injury (NSSI) and suicidal ideation, (2) the link between NSSI and coping, and (3) endorsement of using NSSI to cope with suicidal ideation (anti-suicide function). Thirty-four adolescents hospitalized due to suicide risk (76% female; ages 13–17) responded to daily surveys for four weeks after discharge ($n = 650$ observations). NSSI was positively associated with suicidal ideation at the between- (i.e. relative to others) and within-person (relative to adolescents' own average) levels of analysis. When NSSI and suicidal thoughts co-occurred, adolescents used NSSI to cope with thoughts of suicide on nearly all occasions. While adolescents did not use less adaptive coping when they engaged in NSSI (i.e. within-person), youth who utilized more coping strategies in general (i.e. between-person) had lower probability of NSSI. The probability of NSSI also decreased when adolescents perceived coping to be helpful and for youth who generally tended to perceive coping as helpful. Findings offer fine-grained insights about the intersection of NSSI, suicidal thoughts, and coping among high-risk adolescents, adding to the body of research highlighting the benefit of broadening adolescents' coping strategies as well as assessing their perceived utility.

1. Introduction

Self-injurious thoughts and behaviors (SITBs) are significant public health concerns in youth. Nonsuicidal self-injury (NSSI), referring to self-inflicted injury without intent to die, is reported among 17–18% of adolescents (Muehlenkamp et al., 2012; Swannell et al., 2014). Suicidal ideation and suicide attempts are also common among youth, occurring among 17.2% and 7.4% of U.S. high school students each year (Kann et al., 2018). SITBs are even more prevalent (three to five times higher) among clinical samples of youth (Asarnow et al., 2011; Glenn et al., 2017; Wilkinson et al., 2011).

The association between nonsuicidal and suicidal forms of self-injury is complex. While the two classes of self-injury are distinct with respect to method, frequency, function, and medical lethality (Grandclerc et al., 2016; Hamza et al., 2012), SITBs also demonstrate significant overlap. First, these behaviors often co-occur within person, particularly among clinical samples of youth (Glenn et al., 2017; Nock et al., 2006; Victor and Klonsky, 2014). Second, NSSI is a robust prospective predictor of future suicidal behavior in youth, above and beyond prior suicidal behavior (Asarnow et al., 2011; Ribeiro et al.,

2015; Wilkinson et al., 2011). Taken together, nonsuicidal and suicidal self-injurious thoughts and behaviors are distinct but clearly linked. However, less is known about the association between these SITBs over shorter time periods (e.g., on a daily level) among high-risk clinical samples of youth – populations who are most likely to engage in these self-harming behaviors.

1.1. Coping behaviors and SITBs

Previous research has shown that individuals who engage in SITBs tend to use less adaptive coping styles (Cawood and Huprich, 2011; Guerreiro et al., 2013; Hawton et al., 2006). In fact, NSSI is frequently identified as a coping strategy serving to regulate negative emotions or aversive cognitive states (Bentley et al., 2014; Klonsky, 2007; Nock and Prinstein, 2004; Taylor et al., 2018). With regard to adaptive coping strategies, previous research with college students has found that physical activity and removing self-harm means were endorsed as being most helpful in resisting NSSI (Klonsky and Glenn, 2008). Moreover, cognitive strategies (e.g., positive reframing and reappraisal) as well as support seeking were identified as protective against NSSI among

* Corresponding author. Department of Psychiatry, University of Michigan, 4250 Plymouth Rd., Ann Arbor, MI 48109, United States.

E-mail address: ewac@umich.edu (E.K. Czyz).

community and clinical samples of adolescents (Thomassin et al., 2017; Voon et al., 2014; Williams and Hasking, 2010). Although providing useful insights, the cross-sectional nature of these studies limits our understanding of how coping is related to NSSI in adolescents' daily life. Ecological momentary assessment (EMA) and daily diary paradigms offer a unique advantage of elucidating this relationship in real- or near-real-time while minimizing recall bias (Moskowitz and Young, 2006; Shiffman et al., 2008). However, a predominant focus of existing EMA and daily diary studies has been on affective and situational factors that precede or maintain NSSI (Andrewes et al., 2017; Arney et al., 2011; Kranzler et al., 2018; Selby et al., 2013; Turner et al., 2016).

To our knowledge, only two EMA studies have directly examined the relationship between coping and NSSI. In a study involving 30 adolescents with NSSI histories surveyed twice a day for two weeks, Nock et al. (2009) reported that adolescents most often coped with NSSI thoughts by trying to change their thoughts, talking with someone, or engaging in distracting activities. However, this study did not assess if adolescents who engaged in NSSI also used adaptive coping strategies. A recent daily diary study, which followed 60 young adults with recent NSSI history for two weeks, found that problem-solving coping was associated with higher likelihood of refraining from NSSI while social support was linked with lower likelihood of resisting these urges (Turner et al., 2018). Additional work is needed to advance our understanding of how coping influences the occurrence of NSSI behavior in daily life among individuals who are highly vulnerable to experiencing SITBs.

1.2. Coping with suicidal urges: anti-suicide function of NSSI

Though emotion regulation is the most commonly endorsed NSSI motivation (Klonsky, 2007; Taylor et al., 2018), NSSI may also function to help individuals cope with suicidal thoughts and urges – the anti-suicide function of NSSI (Klonsky, 2007; Klonsky and Glenn, 2008; Saraff and Pepper, 2014). At the same time, cross-sectional research indicates that individuals who endorse the anti-suicide function of NSSI are more at risk for suicidal thoughts and behaviors (Brausch and Muehlenkamp, 2018; Burke et al., 2018; Paul et al., 2015; Victor et al., 2015). While most studies have focused their inquiry on how often NSSI is used to cope with suicidal thinking over longer time periods, two studies have examined the anti-suicide function of NSSI in either a daily diary (Horowitz and Sternac, 2018) or EMA design (Andrewes et al., 2017). These studies found that the anti-suicide function was endorsed infrequently, perhaps due to the low co-occurrence of suicide ideation in these samples. However, these studies did not examine the association between NSSI and suicidal thoughts and behaviors over the short term. It is possible that NSSI serves a protective effect, albeit temporary, against suicide risk over the shorter periods of time (as individuals engage in NSSI instead of suicidal behavior).

While the specific mechanism of risk for suicide via the anti-suicide function of NSSI is not yet clear, some studies (Brausch and Muehlenkamp, 2018; Burke et al., 2018) have suggested that this motive for NSSI may reinforce individuals for dealing with their distress via self-harm and result in their use of more lethal forms of self-injury to cope with distress (Van Orden et al., 2010). Moreover, a meta-analytic review of 52 studies examining individuals who had both attempted suicide and engaged in NSSI found that the strongest correlates of suicide attempts were suicide ideation and greater severity (frequency and number of methods) of NSSI (Victor and Klonsky, 2014). One potential direction of association is that suicidal thinking increases engagement in NSSI for anti-suicide reasons, and that together increased NSSI and suicidal thinking confer risk for suicide attempts. Given that psychiatrically hospitalized adolescents are at particularly high risk for co-occurring NSSI and suicidal thoughts and behaviors (Klonsky et al., 2013; Nock et al., 2006), and experience considerable variability in daily suicidal urges (Czyz et al., 2018), it is important to understand the

extent to which these youth identify the anti-suicide function of NSSI in their daily life.

1.3. Study purpose

Despite a growing number of EMA and daily diary studies focused on SITBs, the phenomenon of NSSI in daily life remains poorly understood among adolescents (see review: Rodriguez-Blanco et al., 2018). Moreover, to our knowledge, there have been no such studies with clinical populations of adolescents who are at elevated risk for suicide. Seeking to address the aforementioned research gaps at the intersection of NSSI, suicidal thoughts, and coping in a clinical sample of adolescents at acute suicide risk, this daily diary study examined: (1) the co-occurrence between daily NSSI and suicidal ideation and (2) the link between daily NSSI and coping. Using within- and between-person levels of analyses, we considered the “when” (within-person) and “for whom” (between-person) the associations between NSSI and these predictors hold true. Finally, we sought to (3) characterize the extent to which adolescents who are already at high risk for suicide endorse engaging in NSSI to cope with suicidal ideation (i.e. anti-suicide function of NSSI) in their daily life; this question is particularly significant in this context in light of the previously-shown link between the anti-suicide function of NSSI and suicidal behavior (Brausch and Muehlenkamp, 2018; Burke et al., 2018; Paul et al., 2015; Victor et al., 2015).

2. Methods

2.1. Participants

Participants were adolescents, ages 13–17, who were psychiatrically hospitalized due to last-month suicide attempt and/or last-week suicidal ideation. Adolescents were recruited to take part in a pilot study of a brief psychosocial intervention (Czyz et al., 2019). Exclusion criteria were: severe cognitive impairment or altered mental status, transfer to medical unit or residential placement, no availability of a legal guardian (ward of state), and adolescents not having a cell phone with text messaging. Of those meeting eligibility criteria, 36 (76.6%) provided parental consent and adolescent assent. We restricted the analytical sample to 34 adolescents who participated in the daily survey follow-up component.

2.2. Procedures

Consented participants completed a self-report survey during hospitalization as well as a series of follow-up assessments (2 weeks, 1 month, and 3 months). Beginning on the first day after discharge, adolescents were also asked to complete one survey each evening for 28 days. A link to the survey, developed using a Qualtrics survey tool (www.qualtrics.com), was sent to participants' phones via text messages between 5pm and 7pm using a secure research platform (TelEMA; Fernandez et al., 2013). Participants responded to the survey within 1–1.5 h. Participants responded to 654 (69.4%) and completed 650 (68.9%) surveys during the 28-day period, completing an average of 19.12 (SD = 7.07) surveys (see Czyz et al., 2018). Adolescents were compensated up to \$222 for all study assessments, including \$4 for each completed daily survey. For additional protocol details, please see Czyz et al. (2018). The study was approved by the participating university's Institutional Review Board.

2.3. Measures

2.3.1. Baseline and follow-up measures

Non-suicidal self-injury (NSSI). At baseline, adolescents were asked about NSSI history using a self-report measure adapted from the Non-Suicidal Self Injury portion of the Self-Injurious Thoughts and Behaviors

Interview (Nock et al., 2007). Adolescents who reported any lifetime NSSI were asked to provide age of onset, what NSSI methods they had ever used, as well as rate lifetime frequency of NSSI on a 7-point scale ranging from “once” to “more than 100 times.” Participants were further asked to indicate the frequency of 12-month NSSI on a 7-point scale from “never” to “every day” as well as the number of NSSI events in the last month.

Suicidal ideation, attempts, and NSSI. The Columbia-Suicide Severity Rating Scale (C-SSRS) (Posner et al., 2011) assesses the severity of suicidal ideation using a 6-point scale ranging from “wish to be dead” to “suicidal ideation with specific plan and intent.” A range of suicidal behavior and presence of NSSI are also assessed. We report on suicidal ideation severity and lifetime suicide attempts (yes/no) at the time of admission, which we obtained via medical record review. The C-SSRS is used routinely as part of clinical protocol prior to admissions. Using C-SSRS, we also report on presence of NSSI assessed at the 1-month assessment.

2.3.2. Daily survey measures

Daily suicidal ideation. Each day, adolescents were asked: “At any point in the last 24 h, did you have any thoughts of killing yourself?” An affirmative response was followed with questions assessing, on a 4-point scale, frequency (“How many times did you have thoughts of killing yourself?”) and, on a 5 point-scale, duration (“How long did these thoughts last?”) of ideation. These questions assessing were based on the C-SSRS (Posner et al., 2011). Accounting for occurrences when suicidal ideation was not endorsed, two continuous scales were created for ideation frequency (0–4) and ideation duration (0–5).

Daily NSSI Behavior. Each day, adolescents were asked to indicate presence or absence of NSSI: “At any point in the last 24 h, did you harm yourself or hurt your body on purpose (such as cutting/burning your skin, or hitting yourself) without the intention to die?” If NSSI was endorsed, participants indicated when the behavior took place in the 24-hour period (e.g., yesterday evening [included time corresponding to yesterday’s survey to 12am], nighttime [12am to 6am], this morning [6am to 12pm], this afternoon [12pm–6pm], this evening [6pm to now]). We differentiated NSSI from suicidal behavior by inquiring each day about presence of attempts.

Daily coping behavior. Each day, teens indicated whether or not they engaged in eight coping strategies in reference to suicidal ideation (“When you had thoughts of killing yourself in the last 24 h, did you do any of these things to deal or cope with your thoughts?”) or, when suicidal ideation was not present, in reference to feelings or stressful events (“In the last 24 h, did you do any of these things to deal or cope with your feelings or any stressful situations?”). The eight coping behaviors included: (1) talked to a family member, (2) talked to a friend or another support person, (3) talked to a therapist, counselor, or doctor, (4) contacted a crisis line, (5) tried to distract self with something else, (6) tried to relax or do something comforting, (7) tried to tell self something calming or positive, and (8) tried a cognitive strategy that involved either (a) thinking about reasons for living (on days suicidal ideation was endorsed) or (b) thinking differently about the situation (on days when ideation was not endorsed). Across all the 28 days, these eight strategies were grouped into thematically related categories: coping by relying on personal support (strategies 1–2), coping by relying on professional support (strategies 3–4), coping using a non-cognitive strategy (strategies 5–6), and coping using a cognitive strategy (strategies 7–8). Each day, adolescents were also asked to rate the extent to which they perceived these strategies as helpful using a scale from 1 (“not at all helpful”) to 5 (“extremely helpful”). Finally, each day, adolescents were asked to indicate whether or not they engaged in NSSI to either cope with thoughts of suicide (on days ideation was endorsed) or to cope with feelings or any stressful situations (on days ideation was not endorsed).

2.4. Data analysis

To determine the relationship between daily NSSI and time-varying predictors, we fitted a series of generalized linear mixed models (using glimmix procedure in SAS) for each predictor of interest (ideation frequency; ideation duration; number of coping strategies; coping helpfulness; and four types of coping behavior: cognitive strategies, non-cognitive strategies, relying on personal support, and relying on professional support). In each model, predictors were group mean-centered (score minus each participant’s own mean), which allowed us to examine within-person effects or the effect of change relative to the person’s own average (e.g., when an individual experiences an increase in a given predictor relative to their own mean, does the probability of NSSI increase or decrease?). Moreover, each model also included the predictor’s corresponding group (participants’) mean to simultaneously examine between-person effects (e.g., do adolescents who experience, on average, a higher level of a given predictor relative to others have higher or lower probability of NSSI behavior?). All models included a random intercept; one model (number of coping strategies) additionally included a random slope, as it improved its model fit. In addition, though not associated with the NSSI outcome ($p = .592$), all models controlled for group effects because the data came from a pilot intervention study. Analyses were conducted using SAS (SAS Institute Inc, 2013).

3. Results

3.1. Baseline sample characteristics

Participants included 76.5% ($n = 26$) female adolescents, with a mean age of 15.5 years ($SD = 1.35$). The racial/ethnic distribution of the sample was the following (more than one category could be selected): 85.3% ($n = 29$) Caucasian, 8.8% ($n = 3$) African-American/Black, 8.8% ($n = 3$) Asian, 5.9% ($n = 2$) Hispanic, 2.9% ($n = 1$) American Indian or Alaska Native, and 2.9% ($n = 1$) Native Hawaiian or Other Pacific Islander.

At baseline, over half of participants (52.9%; $n = 18$) previously attempted suicide. The mean level of baseline suicidal ideation (range 0–5) was 4.06 ($SD = 0.92$). With regard to baseline NSSI, 29 participants (85.3%) engaged in NSSI at least once in their lifetime. The mean age of onset of NSSI was 12.86 ($SD = 1.84$) years. On average, participants endorsed 3.17 ($SD = 2.19$) NSSI methods, with the three most common methods including cutting or carving skin ($n = 26$, 76.5%), picking at wound or other areas to draw blood ($n = 13$, 38%), and either hitting or punching self ($n = 12$, 35.3%) or scraping skin to the point of drawing blood ($n = 12$, 35.3%). Moreover, of those with any lifetime NSSI, 25 (86.2%) engaged in NSSI in the last year at least once, and 22 (75.9%) engaged in NSSI in the last month at least once. Of those who endorsed last-month NSSI, the average frequency was 6.57 ($SD = 8.33$) times.

3.2. NSSI during the follow-up period

3.2.1. NSSI reported via daily diaries

Out of the 650 days adolescents completed daily diaries over the 28-day follow-up, there were 36 days (5.86%) NSSI was endorsed by a total of 15 (44.1%) participants. Participants reported at least 70 separate instances of NSSI across these 36 days and 15 adolescents. The majority of the 70 separate NSSI instances took place during the afternoon between 12pm and 6pm ($n = 27$, 38.6%), followed by nighttime between 12am and 6am ($n = 16$, 22.9%), evening time between 6pm and 12am ($n = 14$, 20.0%), and morning between 6am and 12pm ($n = 13$, 18.6%). There was no statically significant association between daily NSSI and baseline characteristics including age (OR = 0.92 [CI = 0.55, 1.54], $p = .737$), sex (OR = 0.10 [0.01, 0.12], $p = .062$), or a dichotomous Caucasian versus non-Caucasian race variable (OR = 0.64

[CI = 0.13, 3.09], $p = .578$).

3.2.2. NSSI reported at 1-month follow-up

At the 1-month follow-up, 31 participants (91.2%) were assessed. Of those, 6 (19.4%) endorsed NSSI since baseline. In terms of NSSI methods, 4 adolescents reported cutting skin, 1 reported cutting skin and hitting self, and 1 reported scratching skin. When comparing consistency of NSSI endorsement in the subset of 31 participants who participated in the daily diaries and the 1-month follow-up, significantly more adolescents reported NSSI via daily diaries (13 or 41.9% versus 6 or 19.4%; Chi-square = 5.24, $p = .022$). Only 1 adolescent reported NSSI at the 1-month follow-up but not via daily diaries.

3.3. Daily coping behavior

Across the 28-day period, all 34 adolescents endorsed using at least one coping strategy on 85.9% ($n = 556$) of the days (Table 1). Adolescents tended to use coping strategies relying on themselves (79.4% of days) at higher frequency than strategies relying on support from others (67.5% of days). Moreover, while non-cognitive coping strategies (relaxation and/or distraction) were reported most frequently (76.7% of days), strategies involving support from a professional source (mental health provider and/or crisis line) were reported least frequently (20.3% of days). The vast majority of coping strategies shown in Table 1 were reported at least once by all 34 participants with the exception of professional support, which was endorsed by 28 (82.4%) of the sample across the 28-day follow-up period.

3.4. Co-occurrence of daily NSSI and suicidal ideation

As reported previously (Czyz et al., 2018, 2019), suicidal ideation was reported in 24.4% of responses ($n = 159$ events) across the 28-day follow-up; 24 (70.6%) individual participants endorsed ideation at least once across these 159 events. Of note, two participants reported a suicide attempt during the course of this follow-up period.

In the current study, on over half of the days when NSSI was endorsed (58.3%, $n = 21$ days), adolescents also reported thoughts of suicide; these 21 events of co-occurring NSSI and suicidal thoughts were reported by eight adolescents or about half (53.3%) of those who reported NSSI, or by approximately a third (33.3%) of adolescents who endorsed suicidal ideation over the course of the study. On nearly all the days suicidal ideation and NSSI co-occurred (95.2%, $n = 20$ days), adolescents reported that they engaged in NSSI to cope with their suicidal thoughts. In contrast, on days when NSSI was reported without concurrent thoughts of suicide (41.7%, $n = 15$ days), adolescents reported that they engaged in NSSI as a coping strategy to manage negative feelings states and/or stressful situations to a lesser extent (73.3%, $n = 11$ days).

3.5. Between-person and within-person predictors of daily NSSI

On the within-person level, significant predictors of daily NSSI included higher levels of suicidal ideation severity (specifically, ideation frequency and duration) as well as perception that coping strategies were not helpful (Table 2). That is, when adolescents experienced more severe thoughts of suicide as well as when they perceived that coping strategies were not helpful—relative to their own mean—the probability of NSSI significantly increased.

On the between-person level, coping helpfulness and suicidal ideation frequency were also significant predictors of NSSI (Table 2). That is, adolescents who tended to experience more frequent suicidal ideation or tended to perceive coping behavior to be less helpful overall had a significantly higher probability of NSSI. Perception of coping being helpful remained statistically significant at within-person ($OR = 0.52$ [CI = 0.31, 0.87], $p = .012$) and between-person ($OR = 0.24$ [CI = 0.06, 0.89], $p = .034$) levels even when controlling for suicidal

Table 1

Frequency of coping behavior reported daily.

Types of coping behavior (yes/no)	n (%) ^a
Any coping relying on self	514 (79.4)
cognitive strategies	357 (55.3)
non-cognitive (relaxation and/or distraction)	496 (76.7)
	n (%) ^b
Any coping relying on others	435 (67.5)
personal support (family and/or friends)	417 (64.7)
professional support (mental health providers and/or crisis line)	131 (20.3)

^a Notes: N ranges from 646 to 647 observations.

^b N ranges from 644 to 645 observation.

ideation frequency.¹

Finally, while number of coping strategies did not appear to have a significant association with NSSI behavior at the within-person level, adolescents who tended to use more coping strategies overall had a significant lower probability of NSSI. There was no significant association between NSSI and different types of coping strategies at either within-person or between-person levels.

4. Discussion

The purpose of this study was to advance, at the daily-level, our understanding of NSSI and its correlates among youth at significant risk for suicide who were followed daily for one month after psychiatric hospitalization. There are several key findings that emerged from this study.

First, there was a notable relationship between NSSI and suicidal ideation. For over half the time NSSI was endorsed, it co-occurred with thoughts of suicide. Moreover, when adolescents experienced more frequent and enduring thoughts of suicide, relative to their own typical levels, the probability of NSSI behavior increased. Additionally, at the between-person level, adolescents who tended to experience higher levels of suicidal ideation frequency across the study period, relative to those with less severe ideation, also had higher probability of engaging in NSSI. This suggests that both state (e.g., heightened distress) and trait (e.g., individual vulnerabilities) characteristics contribute to NSSI in daily life. This is in line with previous literature pointing to the emotion regulation function of NSSI at the state level (Bentley et al., 2014; Burke et al., 2018; Klonsky, 2007; Nock and Prinstein, 2004) and with prior work highlighting trait-level vulnerabilities that may render individuals at higher risk for NSSI (Chapman et al., 2006; Fox et al., 2015).

Second, our findings suggest that the relationship between coping and NSSI is complex. Expanding on a previous EMA study describing use of coping strategies when adolescents did not engage in NSSI (Nock et al., 2009), we found that adolescents engaged in some form of coping behavior on the majority, or nearly 86%, of the days after discharge. Adolescents tended to primarily use coping that relied on themselves – particularly non-cognitive (relaxation and/or distraction) strategies – although support seeking from non-professional sources was also commonly endorsed. In contrast to a previous daily diary study with adults (Turner et al., 2018), we found no association between particular types of coping and NSSI. It could be that methodological differences, or the fact that Turner et al. examined the relationship between coping and NSSI on days NSSI urges were experienced, may have accounted for the difference in findings. At the same time, we found that broader characteristics of coping were associated with NSSI. Specifically, while the total number of coping strategies used was not

¹ There was a consistent finding when controlling for ideation duration: perception of coping being helpful remained statistically significant at within-person ($OR = 0.53$ [CI = 0.31, 0.88], $p = .015$) and between-person ($OR = 0.23$ [CI = 0.07, 0.82], $p = .023$) levels.

Table 2
Between-person and within-person predictors of non-suicidal self-injury (NSS) behavior.

Variable (range)	Within-person				Between-person		
	N	B (SE)	OR (CI)	P	B (SE)	OR (CI)	p
SI duration (0–5)	650	0.49 (0.15)	1.64 (1.21, 2.22)	.001	0.55 (0.29)	1.74 (0.98, 3.07)	.057
SI frequency (0–4)	649	0.65 (0.19)	1.91 (1.32, 2.76)	.001	0.72 (0.32)	2.05 (1.09, 3.88)	.027
Extent coping perceived as helpful (1–5)	556*	–0.73 (0.25)	0.48 (0.30, 0.79)	.004	–1.47 (0.54)	0.23 (0.08–0.66)	.006
Number of coping strategies (0–8)	647	–0.08 (0.18)	0.93 (0.64, 1.33)	.671	–0.96 (0.42)	0.38 (0.17, 0.88)	.025
Types of coping (yes/no)							
Coping relying on self							
cognitive strategies	646	–0.08 (0.42)	0.93 (0.41, 2.10)	.853	–2.62 (1.61)	0.07 (0.003, 1.74)	.106
non-cognitive strategies	647	0.30 (0.48)	1.35 (0.53, 3.49)	.529	–1.00 (1.73)	0.37 (0.01, 11.07)	.564
Coping relying on support from others							
family and/or friends	645	–0.70 (0.42)	0.50 (0.22, 1.13)	.097	–1.96 (1.55)	0.14 (0.01, 2.96)	.207
mental health professional and crisis line	645	–0.01 (0.60)	0.99 (0.30, 3.23)	.986	–4.68 (2.60)	0.01 (<0.001, 1.53)	.072

Notes: Each row corresponds to a single model including within-person and between-person effects of each predictor; all models controlled for group; *N for within-person analyses; between-person N = 34; *excludes observations when no coping was reported.

associated with NSSI at the within-person level (i.e. adolescents did not appear to use less coping on days they engaged in NSSI), youth who utilized more coping strategies in general, relative to those who tended to use less, had significantly lower likelihood of NSSI. Moreover, there was an inverse relationship between NSSI and perception of coping being helpful at the two levels of analysis: the probability of NSSI decreased *when* adolescents perceived coping to be helpful as well as for youth *who* tended to perceive coping as being helpful more generally. Although perception of helpfulness could be impacted by other factors such as distress, we found that this association held even after accounting for severity (frequency and duration) of suicidal ideation. Moreover, as perception of coping helpfulness was assessed more globally, future research should further delineate if helpfulness of specific coping strategies could provide even more nuanced information. Taken together, consistent with treatment approaches that focus on skills development (see reviews: Brent et al., 2013; Glenn et al., 2019), these results suggest that, in addition to helping adolescents acquire a broad range of coping strategies, assessing to the extent to which adolescents perceive these tools as effective in achieving the desired outcome – particularly because NSSI may be experienced as more effective in regulating distress—represents an important focus of treatment.

Finally, we found that NSSI was regularly engaged in to cope with suicidal thinking. Indeed, the frequency with which the anti-suicide function was endorsed in this sample stands in striking contrast to previous studies in which this function was reported by a minority of the sample (Andrewes et al., 2017; Horowitz and Sternac, 2018). However, the current sample of recently hospitalized youth was more clinically severe than prior samples and thus had a higher co-occurrence of NSSI and suicidal thinking. In light of a growing body of cross-sectional research documenting a relationship between the anti-suicide function of NSSI and suicidal behavior (Brausch and Muehlenkamp, 2018; Burke et al., 2018; Paul et al., 2015; Victor et al., 2015), the high rate of the anti-suicide function among youth already at an elevated suicide risk is notable and of particular concern. Adolescents with co-occurring NSSI and suicidal thinking, who also report engaging in NSSI to cope with their suicidal thoughts, may be a particularly high-risk group in need of more intensive treatment. Although we were unable to ascertain the temporal order of these relationships, the fact that these processes are intertwined is nevertheless noteworthy. There is also a need for future EMA studies to examine the extent to which the anti-suicide function is dominant among high-risk youth, whether an increase in this function may mark an escalation in risk for suicidal behavior, and to delineate the mechanisms that underlie it.

4.1. Limitations and conclusion

The generalizability of findings is limited by the primarily female and Caucasian sample. The daily diary design, though improving upon traditional assessments, is subject to greater recall bias than EMA studies utilizing more frequent assessment. Although it is possible that not all episodes of NSSI were captured, it is important to note that significantly more adolescents reported NSSI using daily diaries compared to the 1-month follow-up assessment inquiring about the same time period. This is in line with previous work showing that more individuals reported related outcomes (suicidal ideation and depression) via ecological rather than traditional assessments (Czyz et al., 2018; Torous et al., 2015). Future work relying on multiple daily assessments would nevertheless be able to address this limitation as well as elucidate the temporal relationship between predictors of interest and NSSI. We did not include an assessment of NSSI thoughts or urges, which would allow for a more nuanced examination of SITBs during this time period. Additionally, our dichotomous measure of coping behavior did not allow us to obtain more detailed information about the extent to which particular strategies were utilized (e.g., single versus extensive use of a strategy). Finally, the sample size at the between-person level was modest and the study was not sufficiently powered to examine if the reported daily-level relationships were associated with suicidal behavior. Despite these limitations, this study's findings expand previous research by offering novel information about the daily experiences of NSSI among high-risk adolescents. The findings highlight the complex relationship between NSSI and features of coping as well as severity of suicidal ideation at the within- and between-person levels. Future research is needed to further examine contextual factors that influence NSSI behavior in high-risk adolescents' daily life.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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